July 1, 2010

Mr. Clyde Trombettas
Cal OSHA
2520 Venture Oaks Way
Suite 350
Sacramento, CA 95833

Subject: Proposed Amenments to Existing Subchapter 14. Petroleum Safety Orders-Drilling and production Article 35. Drilling and Well Servicing Machinery and Equipment Standards

The purpose of this letter is to present our recommendations to update current Cal OSHA standards to address diesel engine safety hazard.

Our input is based on API RP 54 titled Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations and Canadian and European standards on this safety hazard and industry experience.

We thank you for giving us the opportunity to provide our input on this important safety issue.

Regards,

Jogen Bhalla

Existing Standards and Proposed Revisions

Subchapter 14. Petroleum Safety Orders--Drilling and Production
Article 35. Drilling and Well-Servicing Machinery and Equipment
§6625. Emergency Stop Device

Existing Standard:
(b) (2) For a diesel engine, a quick closing valve or equivalent device that will shut off the air into the engine's air intake manifold, a means of releasing the engine compression, provided it is done in a manner that will not produce an open flame or spark or other safe means will be acceptable.

Proposed Revision:
(b) (2) The licensee of the (well / production facility) or a contractor who has contracted to perform any operation at the well / production facility shall provide a certified automatic emergency shut-down devices that will close off the combustion air on all diesel stationary, vehicular and mobile diesel engines operating within 100 feet of the well bore.

(b) (2) (1) Rig power emergency shut down devices should be actuation checked no less than once weekly to determine that they are in proper working conditions. All other internal combustion engine shutdown devices should be actuation checked no less than once each thirty (30) days.

(b) (2) (2) Cyclone spark arrestors in certified for use in zone 1 and 2 areas made of stainless steel shall be provided on all internal combustion engine exhausts located within 100ft (30.5m) of the wellbore.

Supporting information: As California is very susceptible to fires spark arrestors can play an important role. However, Spark arresters are necessary but by themselves do not provide the safety you need to prevent fire and explosion.

Spark Arresters are designed specifically for preventing the risk of fire due to the ignition of flammable materials, caused by spark emissions from the exhausts of internal combustion engines. The risk of fire caused by exhaust sparks is so high that access to many sites (in Europe, Mining in US and offshore oil and gas industry in US) is barred unless engines are fitted with spark arresters, and many countries have legislation to this effect. The risk is greatest with diesel engines, where carbon deposits can build up and ignite. The high ratio of oxygen which is present in the exhaust pipe (when the engine goes off load) maintains the ignition of partially burnt carbon particles which are then discharged as highly dangerous sparks.

Based on my discussion with hundreds of customers, I believe there is lot of confusion on spark arresters and flame trap in the oil and gas industry. To make things worse, to the best of my knowledge, there is no clear standard or regulation on this subject in US for the off-shore and onshore oil and gas industry. Spark arresters are widely used in Europe, AP and Middle East but for some reason in US we only use spark arrestors in the agriculture, off-shore and mining industry and not in the on-shore oil and gas industry.

The flame trap on the exhaust requires frequent servicing as it becomes choked with carbon and as such are not widely used.

The flame usually goes out through the intake but can also cause a backfire inside the exhaust. A spark arrestor will not hold back that flame. Obviously any hot flame will ignite any gas / air mixture. Sparks are bad too, but there is a lot more energy in a flame and a spark might not set off a rich or weak mixture. Hence preventing the flame is essential and an air intake shutoff valve is prevention where flame traps are more like a 'cure'. Also flame traps are expensive and large and impractical for vehicles. Therefore we do suggest installing them in the drilling and production industry.

A spark arrestor (at least one tested properly, as to EN 1834 for example) merely stops lumps of the hot carbon in the pipe breaking away with the gas flow and passing out the back of the tailpipe. A cheap forest type (like the disc Super-Trapp) installed by most of the contractors is poor at cooling the sparks and actually can clog up causing major back pressure increase and engine damage. The cyclonic type is non-clogging and has been approved to zone 1 offshore 'no spark' standards.
UK oil companies require Air Intake Shut off valves , because a release will always cause a runaway and is the first step in preventing an explosion.

Subchapter 14. Petroleum Safety Orders--Drilling and Production
Article 16. Gas Compressors and Engines
§6554. Stationary Internal Combustion Engine Driving Air or Gas Compressors.

Existing Standard:
3) The overspeed trip or overspeed regulator shall be so installed and adjusted as to prevent the engine from overspeeding, and shall be maintained in an operative condition.

Proposed Revisions: Add

" Diesel engine driven gas compressors operating in zone 1 and zone 2 areas shall have a certified automatic emergency shut-down system that will close off the combustion air on the engine"

Subchapter 14. Petroleum Safety Orders--Drilling and Production
Article 46. Liquid Loading and Unloading Facilities and Operations

Existing Standard:
6651-c) When a tank truck engine or an auxiliary internal combustion engine is being used to furnish power to transfer a flammable liquid, the vapors that may be liberated by such transfer shall be prevented from reaching the truck or auxiliary engine. If necessary, the vapors shall be piped to a safe location.

Supporting Information:

In addition to tank trucks, vacuum truck engines loading and unloading tankers are classified as high risk applications by API. Vacuum trucks have to keep their engine running to complete the work and are surrounded by vapors during the operation. Therefore, vacuum trucks should always be protected for diesel engine overspeed. Please note that a diesel engine is not just an ignition source, but a potential detonation source that can explode in less than 60 seconds. Therefore, we propose the following amendment:

Proposed Revision:
6651-(c) When a tank, vacuum truck engine or an auxiliary internal combustion engine is being used to furnish power to transfer a flammable liquid, the vapors may be liberated and may cause engine runaway. A quick closing certified automatic air intake engine overspeed shutdown device shall be installed to safely shutdown the engine in a timely manner. The vapors by such transfer shall be prevented from reaching the truck or auxiliary engine. If necessary, the vapors shall be piped to a safe location.

(d) Cyclone principal spark arrestors certified for use in zone 1 and 2 areas made of stainless steel shall be provided on vacuum truck engine exhausts

These recommendations are for information and use in the future

Subchapter 15. Petroleum Safety Orders--Refining, Transportation and Handling
Article 21. Gas Compressors and Engines
§6874. Stationary Internal Combustion Engines

Existing Standard:
(f) An effective overspeed device shall be installed and maintained in an operative condition on internal combustion engines driving gas compressors

Proposed Revisions: Add

Diesel engine driven gas compressors operating in zone 1 and zone 2 areas shall have a certified automatic emergency shut-down system that will close off the combustion air on the engine in the event of overspeed"

Subchapter 15. Petroleum Safety Orders--Refining, Transportation and Handling
Article 5. Fire and Explosions
§6777. Hot Work Procedures and Permits

Supporting Information:
The Hot Work Permit standard above is a complex process and involves many different people and steps to ensure safety from the risks of runaway diesel engines and other ignition sources. As a diesel engine can explode in less than 60 seconds after they reach the overspeed condition, therefore, a quick automatic overspeed shut down device is the most effective means of preventing engine explosion. Moreover, in case of a sudden flammable release, the last thing the operator wants to do is to go towards an overspeeding diesel engine to manually shut it down in a refinery or oil and gas processing facility. .

In addition, although many petrochemical plants control the use of diesel and gas engines into or adjacent to processes with Hot Work Permits, many only require continuous standby and gas monitoring when welding or burning is occurring. Vehicle entry generally requires an initial check for flammable gases, and periodic re-checks if the vehicle stays in the area (e.g., crane operation). Therefore, the likelihood of detecting a flammable release and getting vehicle engines shut down in time to avoid being potential ignition sources is low.

Based on the input from refinery workers, people assigned to do continuous gas monitoring are typically handling other job assignments at the same time in the plants thus increasing the risk of human error or delayed response.

Traffic Management and Control
Vehicle entry into or adjacent to processes handling flammables is not tightly enforced in some plants. Once vehicles are inside the gate, there is often no control of where they go. So, they may be in the wrong place at the wrong time (i.e., downwind and within the flammable cloud). Even if a flammable leak is detected promptly, not everyone with a vehicle may follow the rules (e.g., turn off engine if not in the vehicle, turn off engine if emergency alarm sounds).

Gas Detection
There are rarely enough detectors installed to pick up all possible flammable material releases. The detectors take some time to detect a leak (up to 1 minute for some types), and it is likely to take 5-10 minutes once a detector alarms before operators verify there is a release and begin to take action to

stop it. Secondly, there is rarely enough confidence in gas detectors to allow them to automatically take any action. By this time, the flammable release will have already reached ignition sources (such as diesel engines) in the vicinity. Even if there is a continuous standby with a handheld meter; it may not detect the leak fast enough to take action.

A sudden release can exceed the concentration of flammable gases or vapors above 20 percent of the LEL and the employer will not be able to take the corrective action in a timely manner to prevent diesel engine fire and explosion.

A running diesel engine may be the first "gas detector" to sense the leak as the surface area of the engine intake can be 4-8 times larger than the gas detection sensor.

Proposed Revision:
Add: If mobile or vehicular diesel engines are allowed during the HOT Work, they must be equipped with overspeed shutdown device and flame and spark arrestors as required standard.

Gaps in Current PSM Standards:

PSM standards are Administrative Controls. Administrative controls address hazards through the development and application of suitable work systems that involves human intervention at every step. Engineering controls are required to address safety hazard associated with the runaway diesel engines. Why?
A runaway diesel engines depending upon the richness of the environment can explode in less than 60 seconds. With all varieties of diesel engines, the common denominator is combustion air. Diesels have a multitude of fuel control schemes but utilize air the same way. Therefore controlling combustion air using an automatic air intake shut off valve is the key to absolute engine control during an emergency.

In case of a sudden hydrocarbon release, the last thing you can expect plant operators to do is to run around the plant with a phone book or a jacket to block the air to shut off their diesel engines. It is just not possible and this is not the way to control ignition sources in an oil and gas facility.

Under the current Cal OSHA PSM standards, prior to any work that involves ignition source:

1) Tests for the presence of flammable gases and vapors shall be made when the concentration of flammable gases or vapors may reasonably be expected to exceed 20 percent of the lower explosive limit (LEL). The tests shall confirm that the concentration of flammable gases and vapors does not exceed 20 percent of the LEL
2) Oil accumulations or other combustible materials shall be removed or protected from ignition when present in exposed areas
3) The gauge valves shall be closed and the gauges drained, or the gauge glasses shall be guarded when gauge glasses contain flammable liquids, vapors or gases and are exposed to the spatter of molten metal.

Assuming, that all the steps are completed, and a Hot Work Permit is issued to complete the work. The scenario can be as follows:

1. A vacuum truck, a crane, a lighting tower or a welding machine is allowed to enter the oil and gas facility
2. Sudden gas leak caused by rupture disc or broken line at the facility creates a cloud that moves with the air
3. Gas Detector detects it in the air once the percent exceeds pre set lower explosive limit –delay upto 40 seconds
4. Gas detector reacts and sound an alarm-delay up to 30 seconds
5. An operator hears it, stops his job and decides what to do next-delay in minutes
6. Assuming the operator or the contractor is close to the engine, sees a running engine like a crane and remembers he or her was told to turn it off when the alarm sounds
7. The operator climbs up the crane looking for the control-depending on the engine location- delay could be in minutes
8. The operator finds the fuel control and turns it off
9. But the engine is consuming the same gas leak cloud and is running on compression ignition of the mixture
10. The engine overspeeds and puts a flame through the exhaust
11. Explosion of the gas and his death results (as in Texas City)
12. The explosion spreads to the whole refinery burning many people, creating economic and environmental damage like Texas City

Typically the operator or the contractor will not go to the engine (at point 6) and will run the other way and (if lucky) save himself but the runaway and explosion would still happen, hurting other people. With several engines, working simultaneously there could be several points of ignition. However, as the runaway diesel engine can explode within seconds, there is a high probability that the operator would be killed. Recent accidents validate this scenario.

If a diesel engine is equipped with an overspeed shut down valve, the engine will be shut down as soon as the engine crosses the safe speed limit preventing explosion.

Proposed Revision:

Add: If mobile or vehicular diesel engines are allowed during the HOT Work, they must be equipped with automatic overspeed shutdown device and flame and spark arrestors as required.